

curiosity and excitement in their garden space. The preliminary analysis reveals examples of actions aligned with environmental curiosity and social skills development. Particular attention will be paid as to whether the actions were child-led or adult-led. The garden served as a tool to broaden the children's attention and curiosity towards their everyday outdoor environments. Children enthusiastically interacted with insects, invertebrates and amphibians found around the garden, often taking initiative to recreate a suitable habitat. Some of the benefits and challenges of using gardening as a tool for play-based learning will be discussed.

“Oh, the weather outside is frightful”: The influence of season on rural children's physical activity

Button, B., Tillmann, S., Clark, A. & Gilliland, J (Western University)

Current research suggests children are not getting the recommended amount of physical activity (PA). This is a major concern as low rates of PA have been linked to numerous negative health outcomes. Most PA research is completed in larger centers and fails to recognize rurality and seasonality as a determinant of PA. The purpose of this research is to fill this gap by examining the PA of children in rural Northern Ontario communities in two different seasons. Using a cross-sectional design data was collected using accelerometers, surveys, and global positioning devices, to gather information on children from four schools in grades 4-8. The exact same methods and students are used to explore differences in two different seasons; fall and winter. Preliminary results show that there is a large difference in moderate to vigorous PA (MVPA) between the two seasons and the two sexes, with all children being more active in fall and males being more active than females. Similar to other studies we found that boys were more active than girls and children were more active in warmer months as compared to cooler months. These findings demonstrate that seasonality has the potential to significantly affect children's PA levels. Future research should examine seasonality as a predictor of MVPA levels. These findings also effect policy and programs targeted towards children, adaptations to policy and programs should be made to accommodate differences in season.

Climate, Water, Energy, and Ecosystems

Chair: TBD

Time: 2:00-3:30pm

Location: QC 505

Mechanisms of pathogenic transmission in agroforests: the role of leaf functional traits in shade coffee systems.

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Coffee leaf rust (CLR), a pathogenic disease that results in premature leaf fall and significant yield loss, has become a major concern in coffee-growing regions, especially in Central and South America, after recent intense epidemics. CLR is caused by the basidiomycete fungus *Hemileia vastatrix* Berk. et Br., an obligate parasite, which infects new leaves via dispersed urediospores. While there is evidence

of biochemical responses of susceptible *Coffea* varieties to *H. vastatrix* invasion, these responses occur too late rendering them ineffective. An important system component that has not been thoroughly investigated is the leaf morphology of both coffee plants and shade trees, which may have a potential coordinated role in CLR incidence and severity on a plot-scale. We hypothesize that (1) coffee leaves with enhanced toughness traits, reduced stomatal density, and greater leaf inclination angle will negatively affect CLR; and (2) shade trees with closed canopy architecture and lower leaf inclination angles in the lower canopy stratum will strongly reduce rain throughfall kinetic energy (TKE) thus moderating *H. vastatrix* invasion. Preliminary results suggest that coffee leaf traits have variable effects on CLR severity, differing between shade management systems, which are similarly reflected in the TKE variability within the shade tree stratum. These preliminary findings advance our understanding of non-chemical resistance measures available in agroecological systems, which may lead to more sustainable and more economical options to battle CLR and pathogen invasions in general.

Accounting for missing data in monthly climate series: Testing rule-of-thumb omission of months with missing values

Conor I. Anderson and William A. Gough (University of Toronto Scarborough)

The '3/5 rule' is a commonly used rule-of-thumb for dealing with missing data when calculating monthly climate normals. The rule states that any month that is missing more than 3 consecutive daily values, or more than 5 daily values in total, should not be included in calculated monthly climate normals. We sought to quantify how much error the '3/5 rule' (and a related rule which we have dubbed the '4/10 rule') permits. We tested the statistical robustness of these rules using observed temperature data from a temperate station and a tropical station. We show that the '3/5 rule' permits an average of between 0.06 and 0.07 standard deviations of error in the calculated monthly mean when 3 consecutive, or 5 random values are missing. For its part, the '4/10 rule' permits a maximum of between 0.08 and 0.09 standard deviations from the true mean when four consecutive values are missing, or up to 0.10 standard deviations when ten random values are missing. The proportional impact of missing values was similar across variables and stations, however February is disproportionately affected by missing values, when compared to other months. We performed a correlation analysis, and show that each additional missing value from a given year-month of data contributes between 0.01 and 0.02 standard deviations of error to the calculated monthly mean. Linear interpolation can minimize the impact of missing values when few values are missing at random, but is less effective when there are consecutive missing values.

Water use and management in the context of climate variation in the Lawra District of Ghana

Abu Thelma Zulfawu (University of Waterloo), Chris Gordon, and Adelina Mensah (University of Ghana)

Access to safe water in sufficient quantities is a key requirement for achieving the Sustainable Development Goals (SDG6). However access to safe water in the right quantities remains a major challenge especially in semi-arid regions and in rural areas, where livelihoods are often tied to access to water. The competing interest for water results in water resources management challenges. We adopted a mixed methodology to assess water quality, water use, and identify adaptation measures in